MODIS Team Meeting Minutes

Minutes of the MODIS Team Meeting held on Tuesday December 6, 1994.

Action Items:

94. Provide a detailed (high fidelity) analysis of scatter in the scan cavity. The results would determine the need for PF near field scatter measurements vs scan angle. Assigned to Guenther 8/23/94 Preliminary results due 10/15/94. Final due 2/28/95.

97. Review the SBRC IR&D report on the Indium Bump process and provide comments on acceptability. Assigned to Roberto, Martineau, and Ellis 9/30/94. Due 10/ 4/94. CLOSED 11/15/94

100. Devise an electronic distribution and communication system to use when GSFCMAIL shuts down. Assigned to Bauernschub 10/25/94. Due 11/29/94.

101. Provide an assessment of the SBRC test plan to measure radiometric accuracy as a function of scan angle position (sections 11.6.3 and 11.7 of the Performance Verification Plan). Assigned to Guenther 10/25/94. Due 11/29/94

105. Review and report on the assigned SBRC test specifications and procedures. Assigned to Daelemans 10/31/94. Due 11/22/94

Attendees:

✓ Richard Weber	Bruce Guenther	Larissa Graziani
✓ John Bauernschub	✓ George Daelemans	✓ Bob Martineau
✓ Rosemary Vail	✓ Patricia Weir	✓ Bob Silva
Lisa Shears	Mitch Davis	✓ Robert Kiwak
✓ Mike Roberto	✓ Ken Anderson	✓ Harvey Safren
✓ Nelson Ferragut	✓ Rick Sabatino	✓ Ed Knight 12/5
✓ Gene Waluschka	✓ Cherie Congedo	✓ Harry Montgomery
✓ Bill Barnes	Jose Florez	Marvin Maxwell
Les Thompson	✓ Gerry Godden	✓ Bill Mocarsky
	✓ Sal Cicchelli	Helen Phillips

The following items were distributed:

1) Weekly Status Report #167

2) SBRC Memos submission from week #159

3) Minutes of the previous team meeting

MODIS Technical Weekly December 9, 1994

General

MODIS will be staying at SBRC through protoflight. I believe this is very good news for our SBRC MODIS team and for instrument development.

The QMR is scheduled to start at 9 am on Monday, December 12.

It will be in 16W, rooms N76/80. SBRC will have about 5 or 6 people here for the review.

There will not be a team meeting on December 13.

Award fee milestone suggestions for the period from January 1 to April 30 are due this week.

A/D Converter Non-linearity

Our electronic engineers believe that each of the 4096 levels of the output of the A/D converter need to be checked to assure the specification is met. Our understanding is that Ken Shamordola is now using a ramp input and that all output levels will be checked.

Bob Kiwak - MODIS Blackbody Crazing

A memo on crazing of blackbody samples was sent to Bob Kiwak on November 29 from Eric Johnson. The following are excerpts from Eric's memo:

Witness samples were placed in high vacuum (10-6 Torr or lower) and temperature cycled 3 times between - 30 degrees C and + 60 degrees C. There was a one hour dwell at each temperature extreme and the temperature change did not exceed 2 degrees per minute. At night, the samples were at ambient temperature at high vacuum. The time at high vacuum was about 4 days.

The "super crazed" pieces have flaked particles from 0.5 to 2.0 thousandths of an inch in size and a tape test pulled a number of particles loose from the surface.

Magnified photos of the problem were included. One hypothesis by SBRC is that vacuum exposure and baking drives out the water from the anodize pores or cells thus enhancing the crazing. The crazing may start as a result of being placed in the hot sealant bath (about 180 degrees F) due to the differences in expansion coefficients. Anodize thickness may play a big part. SBRC's witness samples and most of the Type II anodized samples are of the order of 1.5 thousandths of an inch. The anodize surface crazes even before being exposed to various environments. SBRC has seen that initially uncrazed samples craze after a period of weeks in an ambient lab environment.

In a memo to Bob Kiwak, dated 12/6, Charles He indicates a couple of possible solutions: reduce thickness of coating if possible, change the sealing method to increase crazing temperature. GSFC could determine critical coating thickness for crazing at application temperatures and check vendors for information on different coating sealing methods.

Systems Telecon with SBRC 12/5/94

The following are Tom Pagano's notes on the telecon:

Below are minutes from the bi-weekly systems telecon with NASA.

Systems Engineering Teleconference with NASA 12/5/94

NASA. Knight, Roberto, Montgomery, Barnes, Zukowski

SBRC. Young, Therrien, Pagano

Next telecon 12/19, then 1/9

QMR. Lee, Linda, Charlene Daly, Duane Bates, Neil Therrien, Tom Pagano

Knight. Does the SIS have polarization?

Young: It should be less than 1%. (SBRC is not planning to measure it>)

Barnes: Do you plan to measure it?

Young: Any evidence of there being any polarization?

Barnes: To check.

Knight: Working on the scan angle measurement. Understand BCS will be unpolarized, but wanted to check SIS.

Knight: What is the distance from the SIS to the MODIS?

Young: From entrance aperture of MODIS to the SIS port is nominally 180".

Barnes: What have you done for water absorption.

Young: From Joe Walkers memo and LOTRAN, assumed a 5 m optical path.

Barnes: Why 5 m?

Young: If 180" is right, then if we add another 20" that's 200", that's about 5 m. So it would be about from the center of the integrating sphere. Optical path will be purged with dry nitrogen on PF, but not EM. Spectral measurements with water in the path will be affected.

Barnes: Is that an argument for purging on the EM? Will you measure humidity in the room?

Young. Many things to do on EM. May not be possible for EM. We do have room humidity monitors.

Zukowski. Are the humidity monitors accurate within a purge tent.

Young. I don't know, but would be surprised if they worked well enough to use for correction. If we have the SpMA set up and we look at the band at 6.7 um, that would be the best monitor of how much water we have.

Zukowski. Wants some independent check of humidity.

Young. We don't know how to do this at this time.

Therrien. The SIS would have to be calibrated with the purge tent also. This leads to complications for EM.

Knight. Polarization tests next week? Want polarization angles to overlap response vs scan angle tests.

Young. Polarization tests only done in reflectance region. Response over scan line in infrared

Knight. According to the PVS we're doing it at multiple angles in all bands.

Young. Relative to the PVS where we're saying we use the SIS and the BCS, this is for the PFM. This will not be done that way for the EM. For EM we are using the IAC. We have started acquiring that data for both the VIS, NIR and some IR bands

Knight. Spend a little time on what we're doing on the EM

Therrien. 25 measurements from -60 to +60 with 10 points between -50 to +50 on Friday and Saturday in the region of band 29 and 30. We used an 11 x 11 slit and picked up a few VNIR bands, 10 and 17. There may be other bands as well. The plan is to continue that and pick up the PC LWIR and do the same. We shouldn't expect to see any noticeable change across the scan line in the VIS and NIR. We're using them to check out the FOV primarily.

Barnes. When will you provide the data.

Pagano. QMR will show results. May not be able to provide data by then.

Knight. Any difference in how data is formatted on the archiver for PFM?

Therrien. No. Archiver hasn't changed. PIC only stores it from MODIS as is.

Knight. As long as the data format isn't changing and the way we're

accessing it isn't different, then we can use the same TAC software. In particular SDST will be writing routines and want to know format.

Therrien. We have a single routine to extract data from the data stream.

Knight. Want to put together a level zero data stream. They need to

fabricate it from start, to create test data.

Therrien. Working DN function. Writing it in C. May be usable for

generating data.

Knight. We'd like to get a copy of that.

Pagano. There is a 12 bit to 16 bit reduction.

Knight. SDST needs to put together a data stream that looks like level 0.

Barnes. This is for science data, a little different than for test.

Knight. OASIS progress?

Pagano. We're OK with OASIS. We can execute commands to the MODIS and collect data.

Knight. Would it help any to send out a NASA software person to deliver TAC. What is testing sch

Pagano. We're OK with the TAC. MEM integration next week, Gain and Offset the following we PSA tests before Christmas.

Knight. Near field response test with the help of the modeling should give us a good understanding. W like to travel out for the tests.

Pagano. Be flexible. QMR 3 hr test readiness.

Knight. Test procedures for NFR? Will they be ready before tests?

Young. Yes there will be a procedure, and there will be redlining.

Pagano. Most likely not done 30 days before test.

Knight. Priority is NFR and Calibration Coefficients.

Young. Memo on near field response measurements is out. This will be used as the strawman for the test procedure. 4 of 5 categories. Released last week.

Barnes. Sounds good, that should lead to test procedure.

Pagano. I'll bring a copy to the QMR.

Zukowski. Are we going to have enough dynamic range to get a curve fit. What kind of count level are we getting. What is the noise floor.

Pagano. A 5 to 10% phenomenon.

Young. SNR of 200 about what we need.

Pagano. Signal swings of more than 500 with noise of 1 to 2 bits, and we're averaging about 100 channels, so we should have plenty of SNR. Concern is source stability so we're taking repeated measurements.

Zukowski. Would like to get some summary of your results.

Barnes. Heard that the move to El Segundo will be after PFM.

Congratulations.

End of Tom' s notes.

Note also that John Klineberg visited SBRC on Saturday, December 3. Dr. Klineberg observed the MODIS instrument in the clean room. Looking through the entrance aperture, he was able to see through the optics to the focal plane.

Bill Mocarsky - Integration and Test

12/5/94

I had my telecon with Duane Bates today. He informed me that Vern is out sick, won't be back in until Monday and that it could be something serious.

I&T status:

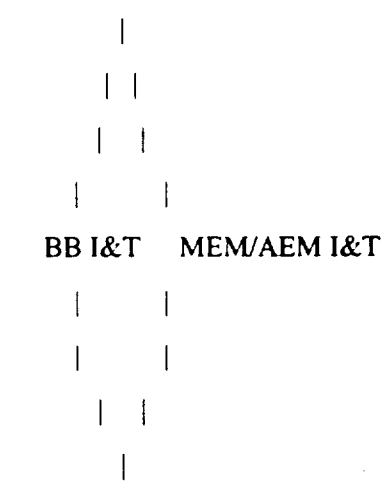
OBA-Mainframe - Integration is done. Have done alignment to the scan mirror. They have checked it against NADIR and 55 deg off NADIR in 1 direction. They expect to have the final check done Saturday. They are doing these tests using the BAEM.

Next week activities - They expect to receive the MEM Monday and start integrating it (electrically). It will not be housed initially in the MF in case they have to pull it apart. Currently the MEM is still in temperature tests. The Night Mode appears to work. The Day Mode gives incorrect data in the packets. He said that he thinks the MEM folks have identified a fix, but is not sure if they will implement it before he gets the MEM.

Expects to receive the black body Monday and start integrating that in MF Tuesday or Weds.

The AEM will be integrated using temporary "mechanical mounts" outside the MF (at least the SAM will be). The interconnects of all electronics to MEM will be using test connectors.

Currently the updated test flow looks like:



Verify cmd/tlm

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MEM I&T in MF

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Polarization Test

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Scatter test

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FSW test

Somewhere in there is a preliminary gains/offset measurement using IAC. There is flexibility in the order of tests.

Note: Looks like they will move to the DMCF in Mid Jan. This is still 1 month away from Sept QMR plan - BUT they haven't lost any more time since I reported last.

Bill Mocarsky

Bob Martineau - Focal Plane Assemblies

Investigation into the cause of the SMWIR S/N 108 failure continues. The readout was tested and found to be functioning as designed. The height of the hybrid was measured at the 4 corners, and this revealed no obvious problem. Visual inspection revealed the presence of some foreign material along the edge of the hybridized chips, but the nature and origin of this foreign material has not yet been determined. The hybrid will be examined through the bottom to see if the fiducial hybridization marks are still in alignment, and will then be pulled apart for close examination of the indium bumps and any contamination which might have wicked in between the chips.

I have asked Mary Dowler for a list of cleaning steps constituting normal cleaning procedure during fabrication and test of SCAs, and also a statement of any extraordinary cleaning experienced by this hybrid.

The recovery plan is to hybridize 2 or 3 backup SMWIR PFM SCAs. The first backup would go into test about January 24th. SBRC would be at risk for a backup till then.

Jose Florez - MEM

MEM Status

Investigation of the data corruption problem in the interface between the FIFO and the FDDI has led to the discovery that the software could not keep up with the data rate in the generation of packet header information for long packets. Modifications were made to implement portions of the header formation as a hardware task to alleviate the load on the software. The result was the successful generation of packets with the software being able to keep up with the data rate.

Temperature testing of the MEM was conducted last week as follows:

- A bake-out was conducted at 70 oC. - Turn-on was tested at -30 oC and +52 oC. - Performance was tested at -10 oC, +60 oC, and +70 oC.

During the cold portion of the temperature test two new problems were identified which are currently being worked: 1) The settling time for access of the Science Data Buffer RAM is too long, which will require the addition of data buffers in order for the memory to be read.2) One of the FIFO's is not working properly.

FAM/CLAM & SAM Status

SBRC is getting ready to install all three units on the instrument.

One piece of good news is that the MODIS folks at SBRC were informed last week that the move to LA.. will be delayed until after the Protoflight Model is finished around June of 1996. That should provided some relief.

Eugene Waluschka - Scatter Analysis

Scatter

A simple "geometric" (near field) scattering analysis was performed for the visible light path in MODIS. No BRDF information was used hence the geometric name. It was hoped that the analysis would show the relative importance, as far as scattering is concerned, of the reflective and refractive surface just from geometric considerations. Unfortunately the results are somewhat inconclusive. However a computer program was created (the simple ray tracer) into which we can incorporate (shortly) the various bidirectional reflective and transmissive functions and get more accurate or more realistic surface scatter predictions. The scatter contribution, from each surface in the optical train, onto the focal plane, is determined by "imaging" each surface onto the focal plane and looking at the resultant light intensity distribution. A more complete description of the steps involved in the computation follows.

Simple scatter calculation

Determining which surfaces could be "bad" scatterers without knowing the scattering "BRDF" at each surface was performed by "imaging" each surface on to the focal plane. The image of each surface on the focal plane was formed by randomly deflecting rays, which would have come to a point focus on the focal plane, at each surface, but only one surface at a time, into a cone with a half angle of 15/705 radians. There was no energy consideration, just ray counting. The results for the "visible" light path are the surfaces before the field stop located between the primary and secondary tend to scatter this "point image" light over the entire focal plane and the surfaces after the field stop scatter light into a circle which is smaller than the focal plane dimensions.

Gerry Godden (hopefully) will supply me the various BRDF and BTDF functions and the coefficients. Once we incorporate that into the scatter model we will have more realistic results.

More Ghosting calculations

Here is a description of the work being performed with Shi-Yue Qiu (Ken Brown is also in the loop).

This is a continuation of the ghosting calculations. Qiu needs to know the functional dependence of the point spread function so that he can, initially, take a "perfect" image and see how it would degrade when imaged thought the optics. The effects which are being looked at are primarily scatter and any ghosting. A more extensive ghosting computation of the VIS and Nir channels was performed with the result that there is very little ghosting. A more complicated calculation has also been performed for the LWIR channel with the result that there is still a fair amount of ghosting present (both cross and along track) when a two and three zone dichroic fold mirror is used to reduce the amount of light reaching the focal plane. It should be noted that these results have to be check, however at present there is nothing obviously which would cast doubt on the calculations.

The computations were performed using the stand alone ray trace FORTRAN program and run on a DEC Alpha computer (primarily because it is a relatively friendly operating system and it is fast - about 106,000

ray surfaces per second). Typically each ghosting computation fires about 100,000 rays which takes less than four (4) minutes to compute.

The main difference between these calculations and the previous ones is the modeling of the dichroic zones at the intermediate focal plane for both the SWIR and LWIR light paths, the modeling of the focal plane filters and permitting a ray to have up to ten wavelengths (with the appropriate indices of refraction for the various glasses). The computation starts by finding two random points one on the ground and the other in the entrance aperture (assumed to be a circle 50 mm below the scan mirror). These two points define a ray to which one of ten wavelengths is attached. The next ray will have the next wavelength with the eleventh ray having the first wavelength and so forth so that all of the wavelengths are uniformly sampled. The ray is propagated to the intermediate focal plane. At that point a check is made to see which dichroic zone it strikes. In the case of the LWIR dichroic if the ray is transmitted it is stopped and if it is reflected it proceeds to the focal plane (assuming that it is not stopped by a aperture). At the focal plane a check is made to see which filter it hits and again a determination is made, based upon the wavelength of the ray, whether or not it is reflected or transmitted. If it is reflected then at all of the following encountered surfaces a series of secondary rays (attenuated to 2% of there original weight) are generated. These secondary rays may reach the focal plane. At which point a check is again made to see if the wavelength of the ray and the focal plane filter will permit the ray to reach a detector element. Scoring is performed only when a ray hits a detector and not, as previously, in a more extend region in the focal plane (this accounts for the need for more rays, the scoring regions are much smaller).

From the above paragraph we see that the computation is very similar to the previous approach, but with the addition of a wavelength dependence for filters and for rays. Some first results indicate that if half the LWIR focal plane is illuminated then the ghosting in the other half is about 2% .

A detailed report will follow.

Eugene Waluschka

Rosemary Vail - Performance Measurement Status Report

Rosemary provided an update on the PMSR.

Harry Montgomery - Archive Software

Harry mentioned that Tom Pagano will be providing some archive software to GSFC for the TAC.

George Daelemans - Thermal Blankets

George mentioned the MODIS EM thermal blankets are complete. Installation is planned for early January

MEM Vibration

There was a phone message from Al DeForrest on December 6. The MEM can be vibrated alone. The MEM is 50% heavier than the mainframe. It will take a very rigid frame to hold it. The MEM structure which was vibrated in Florida was a flight candidate at one time. They can use the Florida vibration test results to assure the MEM receives the proper loads in a vibration test. Al has discussed this with Tom Wolverton and Lee Tessmer.

Mike Roberto

December 7, 1994